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Abstract

EXTRACTION OF RADIOACTIVE FISSION ELEMENTS

Breghneva N.E., Korpusov G.V.,
Patrusheva E.N., Prokhorova N.P.,
Krylov J.S.

Many various extractants having been introduced into chemical industry, it became possible to largely improve and simplify the earlier-applied scheme for fission-product separation which was based on a combination of depositing and extracting operations.

To leave out depositing operations and to replace the previously-proposed tributylphosphate and nitromethane, many extractants were tried. These extractants belong to the class of neutral and acid phosphorus compounds. They are such as phosphates, phosphonates, phosphinic acid, carboxylic and dialkylphosphorus acids.

An investigation was made as to how fission elements are extracted by the above compounds depending on the concentration of nitric acid, elements under consideration, extractants, etc.

On the ground of the data obtained the conclusions were arrived at on the range of application of various systems and solvents with an aim of finding the optimal conditions for separation.

Of all the extractants tried the most suitable proved to be di(2-ethylhexyl) ortophosphoric acid which is characterized by a

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number of advantages as compared to tributylphosphate.

A scheme was developed how to make use of di(2-ethylhexyl) orthophosphoric acid to process radioactive waste solutions containing a sum of radioactive fission elements.

In accordance with this scheme, a sum of rare-earth elements is separated from the basic solution. From the concentrate of the rare-earth elements, which is preliminarily oxidized, cerium is separated in the form of a tetravalent complex which separates from trivalent rare-earth elements at the stage of re-extraction performed by nitric acid with an admixture of an oxidizing agent.

Separation of trivalent rare-earth elements can be achieved only by means of tributyl phosphate and diisoamine ether of methylphosphonic acid under high concentration of nitric acid or by means of di(2-ethylhexyl) orthophosphoric acid under low concentration which seems to be a more promising method.

To separate the elements of the second group such as strontium, barium and calcium, use can be made of tributyl-phosphate with centralizing admixtures. The developed scheme was employed for separation of rare-earth fission elements of a very high specific activity.